

Lessons Learned - Natural Analogs for Landform Design in Arid Climates

David G. Ludwick¹

¹SRK Consulting, 999 17th St. Ste: 400, Denver, CO, 80202, USA

“Landform Design” has firmly entered the mine closure lexicon as an image of ideal reclamation of mine sites. Along with it have come the concepts of geomorphic design that take inspiration from the surrounding landscape, natural analogs, to engineer erosion stable landforms over very long-time scales. Recent literature goes as far to suggest that geomorphic closure design is best practice. However, it may be wise to temper the expectations of what geomorphic design may offer, especially for large facilities and severe topography where removal is not an option. Erosion performance and visual appeal are two objectives which must be balanced with geotechnical risk (especially tailings), construction uncertainty, and cost. Landform design is further complicated by the engineered nature of mine reclamation covers which typically require layered systems (a random fill cover over waste, at a minimum) that are delicate and finite relative to the geologic forces that shape the landscapes in arid regions of the globe. In the Southwest US, a near neighbor to the Rocky Mountains, we have looked to natural analogs to guide the development of practical geomorphic slopes for mine reclamation in the form of catena profile slopes and rock armor. This presentation looks at the lessons learned in geomorphic design using natural analogs, the limitations of natural analogs in design for high-risk mine waste facilities, and thoughts on closure at a geomorphic timescale.

Reference Links:

2017 Covers at a geologic timescale - SME (Rykaart):

https://www.kz.srk.com/sites/default/files/file/Rykaart_MineWasteCovers_2017_0.pdf

2019 Landform Design Approach (Peroor): <https://www.srk.com/en/publications/integration-of-field-erosion-measurements-with-erosion-models-and-3d-design-tools>

2022-10 ACG Erosion Models (Abramson): https://papers.acg.uwa.edu.au/p/2215_76_Chataut/

2023 03 SME Integrated Buttress & Landform Design (Ludwick):

<https://www.srk.com/en/publications/solitude-tailings-landform-an-integrated-buttress-and-landform-design-for-a-closed-tailings-facility>

2023 07 ACG Landform Civil Design (Buechler): <https://www.srk.com/en/publications/repurposing-autodesk-civil-3d-grading-tools-for-natural-landform-closure-design-ppt>

2024 Mining Engineering Magazine Erosion (Pelletier) March 2024 Issue (Subscription required):

<https://me.smenet.org/reader.cfm?page=23>

2020 Planning for Closure (Pelletier) | Assessment of the Erosional Performance of a Semi-Arid Rehabilitated Mine Site and Development of a Predictive Model:

<https://www.gecaminpublications.com/planningforclosure2020/#close>